FEM1.209:360443
ORIGINAL

FLOOD INSURANCE STUDY

COMPLETED

VILLAGE OF CANAJOHARIE, NEW YORK

MONTGOMERY COUNTY

MAY 3, 1982

Federal Emergency Management Agency

COMMUNITY NUMBER - 360443

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Mohawk River — Panel 01P

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PUBLISHED SEPARATELY:

Flood Insurance Rate Map

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FLOOD INSURANCE STUDY
VILLAGE OF CANAJOHARIE, NEW YORK

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Village of Canajoharie, Montgomery County, New York, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert Canajoharie to the regular program of flood insurance by the Federal Emergency Management Agency (FEMA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these federally-supported studies are based. These criteria take precedence over the minimum federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.3. In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were prepared by Edwards and Kelcey for the Federal Emergency Management Agency, under Contract No. EWM-C-0080. This study was completed in June 1981.

1.3 Coordination

Streams requiring detailed study were identified at a meeting attended by representatives of Edwards and Kelcey (the study contractor), the FEMA, and the Village of Canajoharie in June 1979. Results of the hydrologic analyses were coordinated with the U.S. Geological Survey (USGS) and the U.S. Army Corps of Engineers (COE).

On December 8, 1981, the results of the study were reviewed at the final meeting attended by representatives of the study contractor, the FEMA, and community officials. The study was acceptable to the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Village of

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Canajoharie, Montgomery County, New York. The area of study is shown on the Vicinity Map (Figure 1).

The limits of detailed and approximate studies in Canajoharie were determined by the FEMA with community and study contractor consultation at the meeting in June 1979.

Floods caused by the overflow of the Mohawk River within the corporate limits of the Village of Canajoharie were studied in detail. The areas studied by detailed methods were selected with priority given to all known flood hazard areas, and areas of projected development or proposed construction for the next five years, through June 1986.

Canajoharie Creek within the village corporate limits was studied by approximate methods. Approximate methods of analyses were used to study those areas having a low development potential or minimal flood hazards as identified at the initiation of this study. The scope and methods of study were proposed to and agreed upon by the FEMA.

In the course of studying Canajoharie Creek by approximate methods, it was determined that the top widths of flooding were less than 200 feet. Therefore, this stream was deleted from the study.

2.2 Community Description

The Village of Canajoharie is located in the western portion of Montgomery County in the east-central region of New York. Relative to the larger population centers within the region, Canajoharie is situated approximately 37 miles southeast of the City of Utica and 45 miles northwest of the City of Albany. The Village of Canajoharie is bordered on the east, south, and west by the Town of Canajoharie and on the north, across the Mohawk River by the Village of Palatine Bridge. The total land area contained within the village limits is 0.68 square mile.

The climate in central New York is characteristically humid continental. Summer and winter temperature extremes in the area have ranged from -36 degrees Farenheit (^{o}F) at the Village of Salisbury, located 20 miles northwest of Canajoharie, to 102 ^{o}F at the Village of Sharon Springs, located 8 miles south of Canajoharie (Reference 1). The distribution of precipitation is fairly uniform throughout the year with a mean annual precipitation of approximately 38.0 inches (Reference 2).

The Village of Canajoharie is predominately a residential community with approximately 55% of the total land area presently developed. (Reference 3). The residential sector is centered in the southern portion of the village, bordering Canajoharie Creek, and extends to the commercial/industrial area along the Mohawk River. This commercial area consists of approximately 28 acres of land, and includes the blocks between Cliff and Mohawk Streets on the south and Canajoharie Creek on the east, and the blocks to the south of the New York State Thruway and Walnut Street to the west. Beechnut Foods, the largest business and employer within the Village of Canajoharie, is located at the heart of the commercial area. The major transportation arteries serving the village include the New York State Thruway, State Routes 5S and 10, the New

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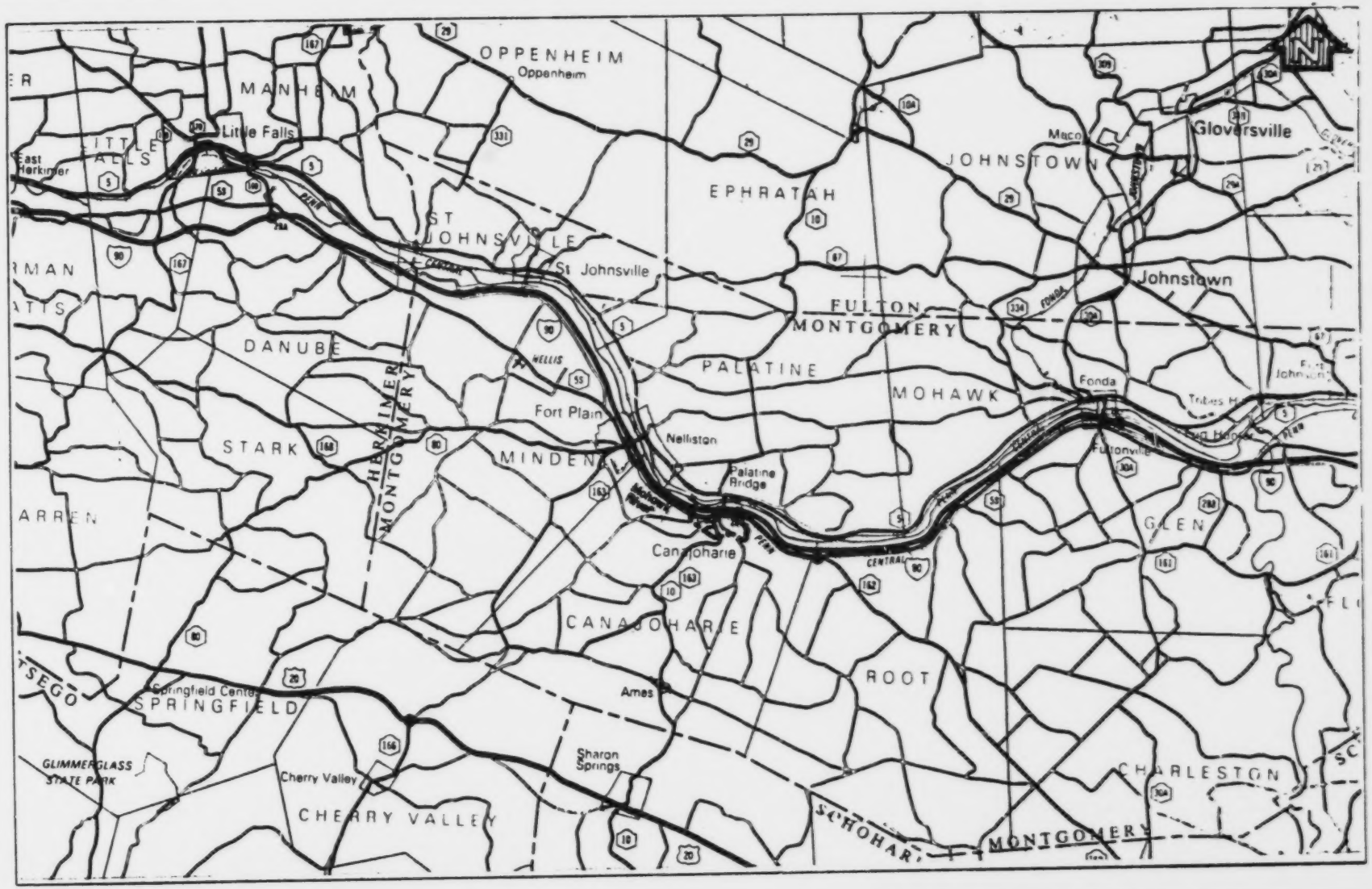

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

VILLAGE OF CANAJOHARIE, NY
(MONTGOMERY CO.)

APPROXIMATE SCALE
4 0 4 8 12 MILES

VICINITY MAP

York State Barge Canal via Canajoharie Terminal, and the West Shore Division of Conrail.

The Mohawk River, which flows east along the northern boundary of the village, is the largest tributary to the Hudson River. Originating in Lewis County, this waterway flows in a southeasterly direction to Cohoes, New York with a total length of 155 miles. Its watershed encompasses 3,462 square miles and is best characterized by its lake and woodland regions north of the river, and rich agricultural land to the south. Major tributaries to the Mohawk River are Caroga Creek, East Canada Creek and West Canada Creek flowing from the north, and Schoharie Creek flowing from the south. Since the late 1800's, portions of the Mohawk River have been incorporated into the Erie Canal System. These navigable waters extend from the Great Lakes to the Hudson River by a series of land cut canals, river sections, and locks.

2.3 Principal Flood Problems

The past history of flooding on streams in Canajoharie indicates that flooding typically occurs in the late winter and early spring months. Flooding during this portion of the year is usually a result of ice blockages accompanied by the spring rainfall and snowmelt. Flooding may also occur during the late summer months as a result of tropical storms tracking northward along the Atlantic coastline, or due to regional thunderstorm activity.

These periods of heavy rainfall during the late summer have produced two of the worst floods on record in the Mohawk Valley. On September 22, 1938 and October 2, 1945, the Mohawk River overtopped its banks and inundated the low-lying area of Canajoharie. Floodwaters covered the areas adjacent to the Mohawk River, including the village's waste treatment facility and most of Beechnut Foods' manufacturing areas. The peak discharge experienced during the September 22, 1938 flood was recorded as 22,700 cubic feet per second (cfs), at the USGS gage No. 1-3470 located approximately 1,800 feet downstream of Rocky Rift Dam near the City of Little Falls (Reference 4). The district office for the Division of Canals and Waterways reported a peak water-surface elevation for this flood as 299.8 feet, at the barge canal Lock 14. The peak discharge associated with the October 2, 1945 flood was recorded as 25,300 cfs at the same USGS gage near Rocky Rift Dam (Reference 1). The corresponding peak water-surface elevation for this flood was reported to be 300.4 feet at Lock 14.

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Figures 2 and 3 show flooding along the Mohawk River during the September 22, 1938 flood.

Figure 2 - View of flooding at Canajoharie Terminal, looking downstream from the north end of the State Route 10 Bridge, during the flood of September 22, 1938.

Figure 3 - View of flooding at Canal Dam 10, Lock 14, looking upstream from the State Route 10 Bridge, during the flood of September 22, 1938.

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2.4 Flood Protection Measures

Currently there are no flood protection facilities along the Mohawk River within the Village of Canajoharie. The movable navigation dams operated by the New York Department of Transportation (NYDOT) were not designed to provide flood control (Reference 5). However, the maintenance of the barge canal right-of-way within the Mohawk River through annual dredging, has greatly improved the waterway's flood handling capability.

Non-structural measures of flood protection are currently utilized to aid in the prevention of future flooding. In addition to the NYDOT channel maintenance, the community currently adheres to and implements the minimum standards as set forth in the Flood Insurance Program.

3.0 ENGINEERING METHODS

For the flooding source studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100- or 500-year period (recurrence interval), have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100- and 500-year floods, have a 10-, 2-, 1- and 0.2- percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one percent chance of annual occurrence) in any 50-year period is about 40 percent (four in ten), and for any 90-year period, the risk increases to about 60 percent (six in ten). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for the flooding source studied in detail affecting the community.

Hydrology for the detailed study of the Mohawk River was based on previous studies conducted by the COE and the USGS at the long term stream flow gages near Little Falls (No. 1-3470) and at Cohoes (No. 1-3575), respectively. The period of record for these gages which are still in operation is continuous from 1927 for gage No. 1-3470 and from 1918 for gage No. 1-3575). The COE analysis for gage No. 1-3470 was adjusted by the COE to conform with the procedures of the regional frequency technique developed by the COE (reference 6) yielding a 100 year frequency discharge of 38,525 cfs. The USGS analysis of gage 1-3575 utilized the Wiebel plotting technique yielding a 100 year frequency discharge of 160,000 cfs. The necessary hydrology for the Mohawk River

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in Canajoharie was subsequently derived using these gages as references and transferring the selected discharges to the study location by relative drainage areas, and a standard transfer equation:

$$\frac{Qu}{Qg} = \left(\frac{Au}{Ag}\right)^a$$

where Qu and Qg are the discharges at the desired ungaged site and the gaged site, respectively, Au and Ag are the drainage areas at these points, and a is an empirical variable used to coorelate data between drainage basins. This procedure was utilized to provide hydrologic continuity with previous or current studies which also use these gages as a reference.

A summary of drainage area-peak discharge relationships for the Mohawk River are shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs) 10Year	50-Year	100-Year	500-Year
MOHAWK RIVER					
At the downstream corporate limits	2,027	47,300	64,655	71,410	84,805
At the NYDOT Barge Canal Lock 14	1,905	44,065	59,100	65,010	76,750

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding source studied in detail in the community were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along this flooding source.

For the Mohawk River, water-surface elevations of floods of selected recurrence intervals were computed using the COE HEC-2 step-backwater computer program (Reference 7). All hydraulic computations relative to the NYDOT movable barge canal dams, were performed with the dam gates raised. The HEC-2 computer model for the Mohawk River was calibrated using high water marks produced by the March 27, 1970 discharge. Selection of this discharge was based on the confidence that the floodmarks would accurately approximate an open channel flow condition. The natural (ice blockages), or man-made (NYDOT dams) restrictions frequently encountered during the periods of peak flows were not present at this time. Floodmarks for the Mohawk River were obtained from the gages located at each NYDOT navigation lock. When necessary, these floodmarks were transferred linearly between gages to selected sites within the reach.

Cross sections for the backwater analyses of the Mohawk River were obtained from aerial photographs flown in December 1979, at a scale of

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1:9,600 (Reference 8). The topographic maps prepared from the aerial photographs contain contours at 5 foot intervals. The below-water sections and bridge, dam, and culvert geometrics were obtained by field measurement. Cross sections were specified at intervals which would accurately model the stream according to the computer program input requirements.

Flood Profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals. Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway is computed (Section 4.2), selected cross section locations are shown on the Flood Boundary and Floodway Map (Exhibit 2).

Channel and overbank roughness factors (Manning's "n") used in the hydraulic computations were developed using reference material from Roughness Characteristics of Natural Channels (Reference 9), engineering judgement, and field observation of the stream and flood plain areas. Two roughness coefficients were used for the main channel of the Mohawk River. The primary value of 0.033 was used exclusively in areas where the overbanks were heavily overgrown or the channel showed significant deposits of gravel or cobbles. An alternate value of 0.030 was used in the remaining cleared areas and at bridges or dams where the channel becomes more efficient. Overbank roughness coefficients ranged from 0.055 for moderate brush to 0.085 for wooded regions. Extremely large roughness coefficients, typically between 0.3 and 3.0, were used in areas of ineffective flow. These regions include low-lying areas where floodwaters may become trapped by a topographic feature, or areas of building concentration.

Starting water-surface elevations for the Mohawk River were obtained from the Town of Canajoharie Flood Insurance Study (Reference 10). All elevations used in this study are referenced to the National Geodetic Vertical Datum of 1929 (NGVD), formerly referred to as Sea Level Datum of 1929. Locations of the elevation reference marks are shown on the maps.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the Flood Profiles (Exhibit 1) are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

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4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FEMA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For the stream studied in detail, the boundaries of the 100- and the 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:4,800 with a contour interval of 5 feet (Reference 8). In cases where the 100- and the 500-year flood boundaries are close together, only the 100-year boundary has been shown.

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 2). Small areas within the flood boundaries may lie above the flood elevation and, therefore, may not be subject to flooding. Owing to limitations of the map scale and lack of detailed topographic data, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights. Minimum standards of the FEMA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodway in this report is presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

The floodway presented in this study was computed on the basis of equal conveyance reduction from each side of the flood plains. The results of these computations were tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 2). Portions of the floodway widths for the Mohawk River extend beyond the corporate limits.

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
Cross Section	Distance[1]	Width[2] (Feet)	Section Area (Square Feet)	Mean Velocity (Feet per Second)	Regulatory	Without Floodway (Feet NGVD)	With Floodway	Increase (Feet)
MOHAWK RIVER								
A	2,330	480	10,973	6.5	300.5	300.5	301.5	1.0
B	4,792	545	13,505	4.8	301.5	301.5	302.2	0.7

[1]Feet above corporate limits

[2]This width extends beyond corporate limits

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

VILLAGE OF CANAJOHARIE, NY
(MONTGOMERY CO.)

FLOODWAY DATA

MOHAWK RIVER

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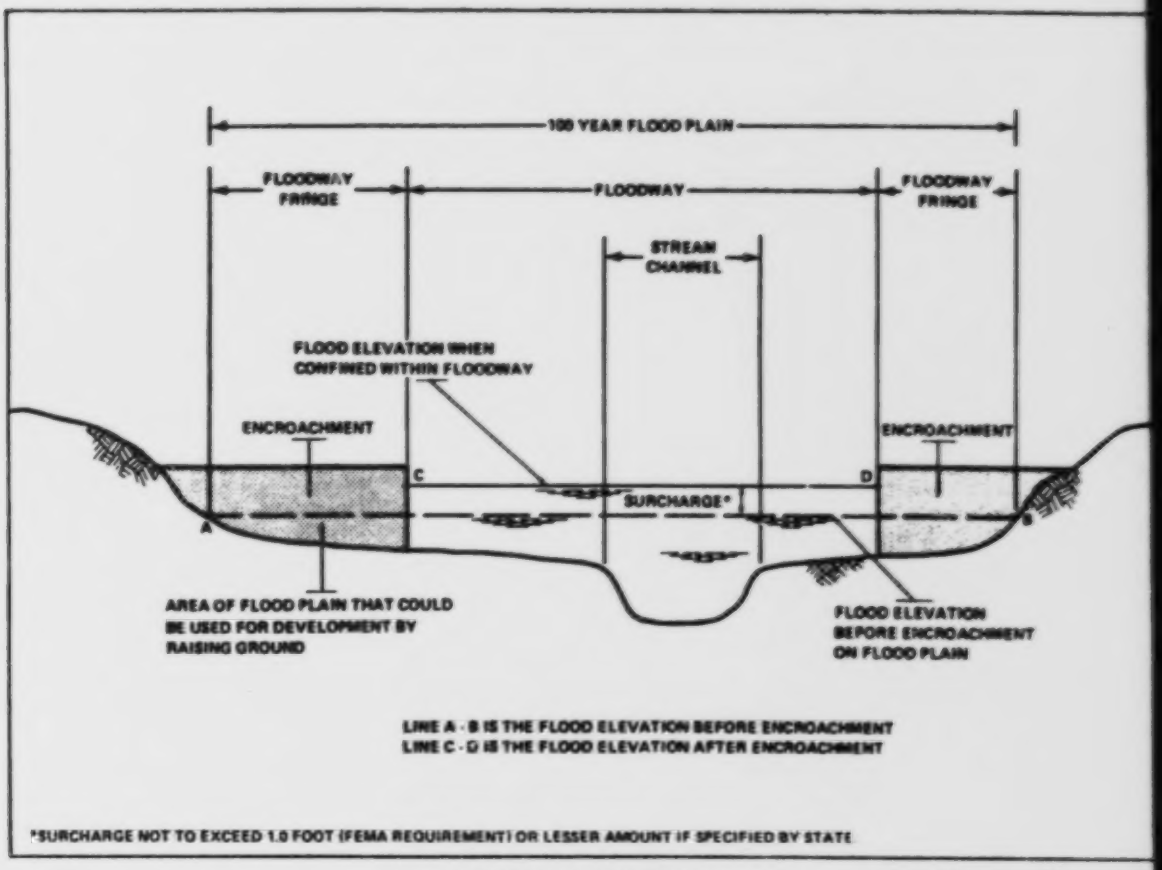
1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 4.


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FLOODWAY SCHEMATIC Figure 4

5.0 INSURANCE APPLICATIONS

In order to establish actuarial insurance rates, the FEMA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHFs), and flood insurance zone designations for the flooding source affecting the Village of Canajoharie.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

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Average Difference between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The location of the reaches determined for the flooding source of the Village of Canajoharie are shown on the Flood Profiles (Exhibit 1) and are summarized in the Flood Insurance Zone Data Table (Table 3).

5.2 Flood Hazard Factors (FHF)

The FHF is the FEMA device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their assigned FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest 0.5 foot and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, the accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of the Village of Canajoharie was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A10: Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones assigned according to FHF.

Zone B: Areas between the Special Flood Hazard Areas and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; also areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and, areas subject to 100-year flooding from sources with drainage areas of less than one square mile. Zone B is not subdivided.

Zone C: Areas of minimal flooding.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevations for the flooding source studied in detail in the Village of Canajoharie.

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Flooding Source	Panel[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND 10% (10-Year)	2% (50-Year)	0.2% (500-Year)	Flood Hazard Factor	Zone	Base Flood Elevation (Feet NGVD)[3]
MOHAWK RIVER							
Reach 1	01	-4.8	-1.2	+2.3	050	A10	Varies

[1] Flood Insurance Rate Map Panel

[2] Weighted Average

[3] Rounded to Nearest Foot - See Map

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

VILLAGE OF CANAJOHARIE, NY
(MONTGOMERY CO.)

FLOOD INSURANCE ZONE DATA

MOHAWK RIVER

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Village of Canajoharie is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FEMA.

6.0 OTHER STUDIES

Flood Insurance Studies are currently being conducted for the surrounding Town of Canajoharie, and the Village of Palatine Bridge (References 10 and 11). Results of these studies for the Mohawk River are concurrent with the results of this Flood Insurance Study.

This study is authoritative for purposes of the Flood Insurance Program, and the data presented here either supersede or are compatible with previous determinations.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the Insurance and Mitigation Division of the Federal Emergency Management Agency, Regional Director, Region II Office, 26 Federal Plaza, Room 19-100, New York, NY, 10278.

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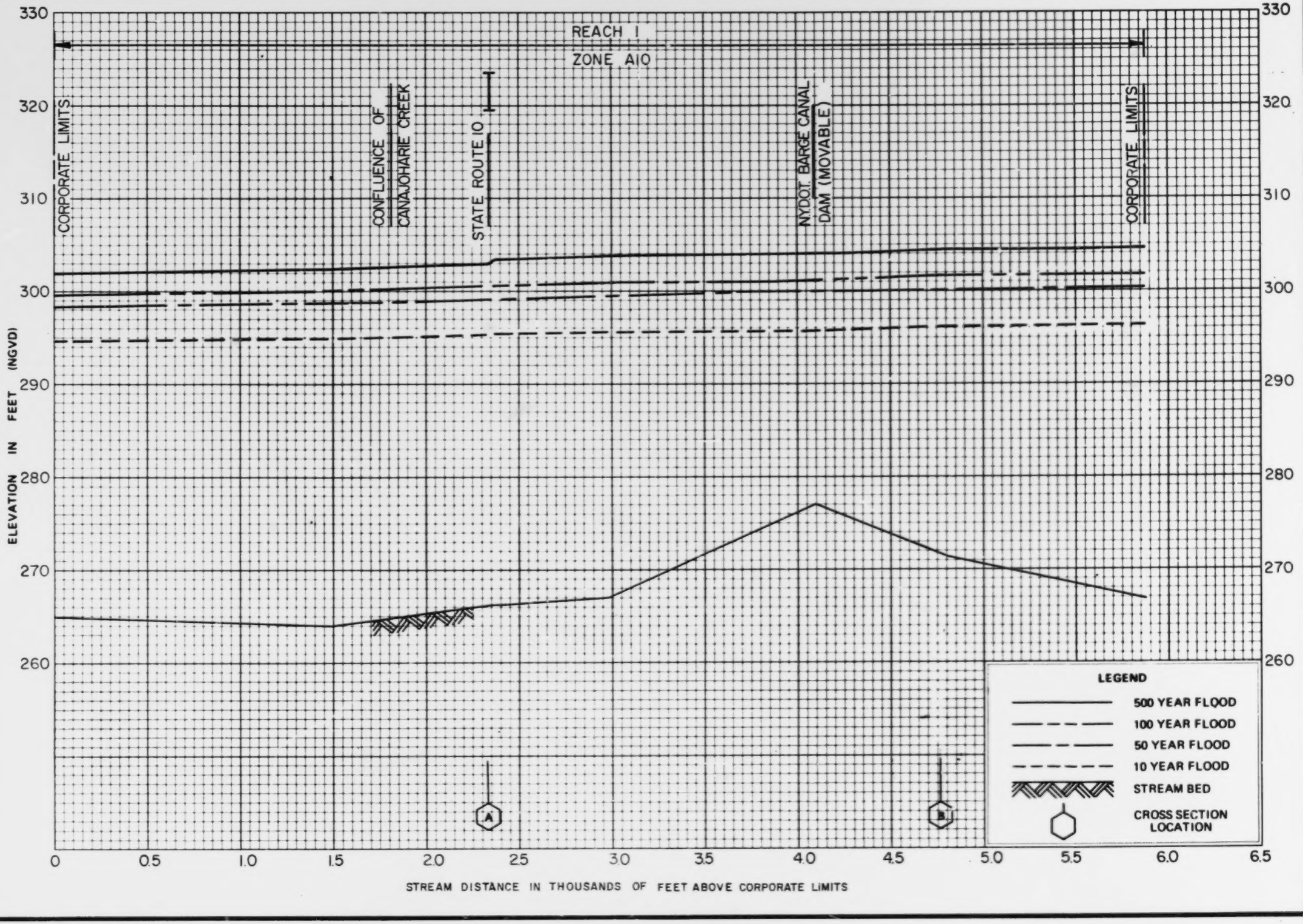

FLOOD PROFILES

MOHAWK RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

VILLAGE OF CANAJOHARIE, NY
(MONTGOMERY CO.)

01P